

ROYAL SOCIETY OF VICTORIA
1996 J. E. CUMMINS ORATION

18 July 1996

Delivered by DR JOHN W. STOCKER FTS FRACP

LUCY'S CHOICE

President of the Royal Society of Victoria, Max Lay, Federal Minister for Science, Peter McGauran, Council Members, distinguished guests,

I am pleased to deliver the 1996 J. E. Cummins Oration of the Royal Society of Victoria, a body whose history reaches to the gold rush times. Here in the capital city of the gold rush state, 150 years on, I wish to think with you about resources—what will be the gold lode of the coming century?

There is no doubt that it must be people—not 'knowledge' or 'information' which for me represent abstractions that defy the grasp, but people who can use these as tools to build a great and prosperous society. As an industrial research manager, as Chief Executive of CSIRO for five eventful years but most of all as father of two teenage daughters, I've had much occasion to think about the human resources we will need to secure for Australia this new 'rush of gold'.

Fellows of that 'other' royal society, the Royal Society of London, had no doubt about what it would take from Australia's earliest days. Erasmus Darwin, grandfather of Charles and a celebrated poet and polymath of his day acclaimed thus in 1790 the glorious prospects which he envisioned for the infant nation:

*'Here future Newtons shall explore the skies.
Here future Priestleys, future Wedgwoods
rise'*

In invoking Sir Isaac Newton, one of the greatest mathematical minds of any age, and Joseph Priestley, the brilliant freethinker and chemist, Erasmus was clearly prophesying a future for Australia as an empire of the intellect. The odd man out in his exemplary triumvirate might appear to be the industrialist, Josiah Wedgwood, founder of the famous pottery dynasty.

But in some ways Erasmus, writing more than two hundred years ago, saw Australia's needs more clearly than many people since. We shall return to Josiah Wedgwood later.

When HMS *Beagle* called at Sydney in 1836, her young naturalist Charles Darwin was at first inspired by what he saw: 'ancient Rome, in her imperial grandeur, would not have been ashamed of such a colony,' he enthused, even going so far as to rate the settlement among the 100 wonders

of the world. But as Darwin explored further into Sydney society and surrounding NSW his view became more jaundiced. Finally he concluded that the depauperate landscape and frequent droughts would preclude substantial agricultural development, and the colony would have to draw its sustenance from commerce and manufacturing industry.

History might have proved Darwin wrong in respect of agricultural development—but history has a funny habit of confounding even the most self-evident of observations. It may be that, at the dawn of the 21st Century it is poised to do so once again.

The world of the coming century in which Australia will find itself enmeshed will be perilous and challenging in ways which make the great issues of the 20th Century seem modest.

In the past half century, the central issue of the human destiny has been whether we would ruin civilisation with fearsome weapons of mass destruction.

In the coming century, the issue will be whether humanity consumes, pollutes and populates itself into crisis.

Human numbers are marching inexorably towards 8.5 billion by 2020, more than 10 billion by the middle of the century. Virtually all this growth will take place in the poorest countries and in the most fragile regions ecologically.

Merely to feed this many people at the most basic level will require the production of an additional 800 million tonnes of grain and 50 million tonnes more fish.

Yet 40 per cent of the world's croplands are already degraded, along with a quarter of its forests and its pastures, while in the oceans, the last great source of food, the global fish catch is in decline.

World demand for fresh water is rising at twice the rate of population growth, disputes between nations and ethnic groups over water are likely to lead to conflict and even to outright war.

Even the atmosphere and climate are at risk. Today the world burns 3.5 billion tonnes of coal.

But by 2050, China *alone* plans to burn 5.5 billion tonnes. While human numbers are set to double, economic activity—including the use of energy and water—is forecast to rise fivefold.

Despite the great advances in food production and medicine of the past thirty years, 800 million people still go to bed hungry, 1.3 billion remain abjectly poor, and 400 children die from malnutrition-related disease every fifteen minutes.

A world in which so many are hungry and lack even the basic essentials for a healthy and productive life is an unstable world. This instability, as the world's leading military analysts are already recognising, cannot be quarantined to a few, impoverished regions. It will spill over to affect everyone on earth—in food prices, national security, tidal movements of refugees, epidemic disease, disruptions to trade and economic growth, and the progressive undermining of the earth's life support systems of soil, air, water and biodiversity.

As US journalist Robert Kaplan puts it: 'it is time to recognise the environment for what it is ... *The national security issue of the 21st Century*'.

These are the stark realities with which today's young Australians will have to contend as they make their way in the 21st Century. The question I wish to address tonight is 'how well are we equipping them for the challenge?'.

There is no doubt that humanity is embarking on a new age, call it what you will—post-industrial, post-modern, the information age. An era that will rival and dwarf the previous revolutions in metallurgy, agriculture and industrialisation.

The defining context of this new age is that, for the first time, human wants and needs are coming into direct collision with the earth's capacity to supply them.

Until recently most human development strategies were predicated upon the assumption that there would always be an unlimited supply of resources—of food, minerals, arable soil, clean freshwater, timber, energy. It is becoming evident that this no longer holds true.

Australia is the offspring of the resources era, when there was always a patch of untilled earth, an unexploited forest or fishery, an untapped oil reserve or mineral deposit. Our economy has been largely shaped by such discoveries, and, equipped with new technologies, there is little reason why we should not continue to add to them for another century or so.

But we need to ask ourselves, very carefully, whether it is wise to depend predominantly on such resources, when the rest of the world is moving along a different path.

We are on the threshold of a different time. One in which material resources are ever more scarce, but in which human resources are ever more abundant—intellect, creativity, inventiveness.

Ake Anderson of the Swedish Institute for Future Studies calls this revolution 'The C-Society', because in his view it will be dominated by communication, cognitive capacity, creativity and competitiveness.

These, he argues, are the qualities which will define who wins and who loses in the rough-and-tumble world of the 21st Century.

Already the new allegiances on which this society is forming are becoming clear. For the past 200 years the world has been demarcated into nation states. But the carefully-drawn map of the globe with which we grew up, with its fastidiously-ruled borders and colourfully-tinted countries is a fiction. It no longer exists, save in the minds of cartographers. It does not mark those places where anarchy has already swept away all semblance of government, where ancient tribal loyalties have resurfaced with a vengeance. It does not mark the new cities, the huge, festering shanty towns where cocaine and the AK47 are the only law. It does not mark the new axes of development which leap across borders, cultures, political and religious beliefs, or the network of businesses, small, medium and large which now spans the globe.

It is in these new corridors, corridors marked by ideas which travel along optic fibre cables at the speed of light, where the next human revolution is unfolding.

Snaking across England, from Cambridge in the east through Stanstead and Reading to Bath in the west is such a wellspring of 21st Century creativity—a wellspring of new ideas, technologies, dynamic young companies with high tech solutions to serious problems. I am a director of one of these—Cambridge Antibody Technology—and I love the bustle of ideas which are its very marketable asset.

Another begins on the western fringe of Tokyo, and unwinds through Osaka, Kyoto, Kobe and Nara, then leaps across to Seoul and on into China, through Shanghai, Hang Zhou and Guangzhou.

A third spears up the heart of Europe, from Basel in Switzerland, through Karlsruhe, Heidelberg and Stuttgart and on across the Baltic into Gottenburg and Stockholm.

A fourth is born in San Francisco, slips down the west coast of California picking up L.A., Orange Country, San Diego and Tijuana in Mexico.

I've had the good luck to have had some involvement with all of these.

And along these corridors flow the ideas, discoveries, new technologies and minds which are building the 21st Century. You won't find them marked on any map, because they exist only in the photo-electronic ether. They are great webs which consist of universities and private laboratories, foundations, corporations large and small, alliances which bond and dissolve as opportunities come and go. They are fountainheads of prosperity and advancement.

What sets them apart from the other regions of the world, and even from their own immediate hinterland is a sense of urgency, of striving—to discover, to create, to compete, to succeed.

These ambitions are strong enough to overcome any political, religious, ethnic or nationalistic obstacles. Those who have the vision force their way into the network. Those who lack it are fated to become the provincial backwaters, the outlands of the 21st Century.

Where Australia sits in this emerging complexity is not easy to define. In certain fields such as medicine, agricultural and environmental science we are a part of it, but in most areas we are at the periphery, an onlooker rather than a participant. We are the hostages of our history: two hundred years of belief that resources, rather than knowledge, are our greatest asset. What Donald Horne bitingly termed the 'lucky country' mentality.

How this has paid off for us in recent times is plain to see. For 28 of the past 30 years, this country has traded at a loss. Between 1980 and 1995, for example, Australia Inc. lost more than \$200 billion on the balance of current account. Over roughly the same period Taiwan, a country also of 18 million people, made a profit of \$250 billion. No wonder *The Economist* magazine last year described us as combining 'a third world economy with a first world standard of living'.

One of the chief reasons for our poor performance is the fact that we have on the whole persisted in the export of products which are simple and cheap, while importing those which are sophisticated and expensive—a fact which Barry Jones was rubbing our noses in more than a decade ago and which I am pleased to see Minister McGauran picking up in recent statements.

We have also, in 15 years, managed to lift national debt from under \$20 billion to more than \$185 billion—a point at which it takes virtually the entire earnings of our agricultural sector, for example, just to service the interest charges.

The consequence of this has been a fire-sale of Australian heirlooms and to overseas buyers—from Vegemite, Minties and Arnott's biscuits to the Agc, Qantas, insurance firms, urban real estate, power and water authorities. Not many people seem to grasp the significance of the fact that Australia can now no longer afford to own its own assets.

One of the reasons for this is to be found in the Nobel prizewinning writings of two economists, Paul Romer and Robert Solow, who argued that the secret ingredient of high performing nations was not capital or manpower—but innovation. It was not *what* you knew that was important, so much as what you *did* with the knowledge. This doctrine is known as new growth theory, and though it was discovered almost 20 years ago, has yet to make much impression on Australian economic thought.

Yet you only have to look at Australia in the context of the Asia-Pacific. At a time when virtually every other country, no matter how poor or underdeveloped to begin with, is making its way up the ladder of world living standards, we have fallen from fourth place to 22nd. We have now been overtaken in GDP per capita by Japan, Singapore and Hong Kong, according to the World Bank.

And yet Australia is far more richly endowed in its ability to gain knowledge than most other countries of our region. We have one of the world's highest levels of public sector investment in science. Our researchers, especially in areas such as medicine, astronomy, agriculture and biology have an impact on world knowledge out of all proportion to their numbers and resources. Our scientific efficiency is rated very high.

Despite some fall-off in recent times, we are training new scientists and engineers at a rate faster than most OECD countries.

So what is wrong with us?

The answer is that we are not very good at realising the *value* of the knowledge which we generate.

Nor are we very good at turning that valuable knowledge into commercial and economic success.

A recent study by the Bureau of Industry Economics noted that while our science system performs strongly in world terms, the links between it and industry are still perilously weak.

Private sector investment in R&D is far below the average for either the OECD or newly-industrialising countries. Business investment in our universities, for example, is almost negligible.

As a consequence, many of our best ideas and our best researchers are driven offshore to develop

and commercialise their discoveries. The venture capital and risk taking mentality simply does not exist in this country to support them.

This is acutely ironical, considering that Australians risk—and lose—around \$10 billion every year on slow horses or dogs and cunning poker machines.

This reluctance of Australians to gamble on their own brains, but rather on everything else including two flies crawling up a wall, is a dangerous national condition as we enter an age when the ability to exploit intellect and creativity will be decisive.

At the start of my speech I referred to the English potter Josiah Wedgwood, a man whom Erasmus Darwin put on an equal footing to one of the greatest mathematicians and one of the greatest chemists of all time, as the sort of person needed to inhabit and lead the new country of Australia.

Jos Wedgwood suffered an attack of smallpox as a child which led to his leg being amputated. His disability, however, proved one of his greatest advantages, because it led his enquiring mind into many important insights and discoveries. Jos Wedgwood was not merely a farsighted industrialist, he was also a scientist, a technologist, a gifted artist whose products graced the tables of the royal palaces of Europe as well as far humbler homes, and a shrewd-headed businessman whose company remains an international by-word for excellence after more than two centuries.

Erasmus Darwin was right: Wedgwood exemplifies the broad combination of talents and skills which Australia today so sorely needs if it is to take advantage of its greatest and most neglected asset, our knowledge base.

If we are not to fall behind our region, Australia needs a new generation of managers who combine business acumen with technological mastery, creativity with understanding.

It is of little use our products being scientifically brilliant if they are not also superbly engineered, aesthetically pleasing, cleverly attuned to customers' wishes and intelligently marketed. The true value is often in the latter part of the chain.

Science, technology, design and information will be the determinants of business success in the coming decades. They will decide whether an individual or a company is admitted to the corridors of progress, or languishes sadly in the provincial hinterland.

Ladies and gentlemen, Australia is already so richly endowed with the potential to gain admittance to these corridors of the future, that it is a matter of wonder we have made so little progress.

In my introduction I emphasised that food, population and the environment will be the focal issue of the coming century. Is there any country in the world with richer credentials in the area of sustainable land and water management? Which grows a wider range of animals and plants in so many different environments? Which knows more about the unique system known as landcare, whereby whole communities come together to manage their catchments and districts more sustainably?

If the world faces a crisis over water, land and food, then Australia also has answers to that crisis. We have the knowhow to defuse disaster.

Our minerals industry has concentrated for years on the export of raw materials—but in the past five years there has been a quiet revolution. It has become a knowledge exporter. Last year sales of mining knowhow exceeded \$500 million—more than nickel or diamonds. With strong growth in demand for green mining technology, for techniques like the Hi-smelt steelmaking process, the potential is there for knowledge exports to join coal and gold as one of our top three mineral exports.

In medicine, health and nutrition Australia has a superb scientific track record which is at last starting to be converted into commercial advantage through firms such as F. H. Faulding, CSL, AMRAD, Peptech, Biota and the like. However one of our greatest opportunities lies in the development of systems which *prevent* disease, instead of simply curing it. The CSIRO Division of Human Nutrition is leading research into foods which are carefully profiled to combat heart disease, cancer and other degenerative disorders. Worldwide, prosperous societies are seeking foods which are not only clean, safe and delicious—but also which preserve one's vigour, youthfulness and good health. Nowhere is demand for such foods stronger than among the rising middle classes of Asia—and this too must surely be one of our greatest opportunities.

I also described how humanity was now in collision with the earth's natural resources. In future we must all make more from less. We must recycle water safely, return nutrients to the land, use more renewable energy, and exploit what for many of us today is regarded as simply waste. Indeed, I venture to predict that our urban waste streams will become the mines of the future. But there are many other things which can also be harvested from the waste stream—metals and minerals, nutrients, fibre and energy, even fresh water.

Australia is a world leader in devising technologies to recycle and re-use wastes, to protect

and monitor natural systems. And companies like Pratt Industries are turning this knowledge to commercial advantage here and in the United States.

We urgently need to realise value from all this knowledge through a new breed of Australian—technologically savvy, commercially shrewd, and sensitive to issues such as aesthetics and the environment.

They must have the education and training which enables them to penetrate the corridors of progress and development. A science or engineering degree is no longer sufficient. It must be mated with other skills—law, commerce, Asian languages, communication, and the humanities and social sciences.

Today one of the greatest challenges facing us all is how to adapt technology for society, rather than the other way around. We desperately need young Australians who bridge both worlds, who combine both sets of skills, who can understand the technology but are also alive to the concerns and anxieties of ordinary people about how it will change their lives.

A clever country is not merely a scientific society. We are already that. A clever country is one which is adroit at adapting science to people. It is also a society capable of imagination—and swift, decisive action. A society of the intellect,

as well as one which makes wise use of natural resources.

What of Lucy's Choice? Lucy is my elder daughter and, having charted the choppy waters of the VCE assessment tasks and exams, she has embarked on one of the exciting bridging options, a law-science degree at Monash University. It was *her* career decision and that of her friends that led me to search my own experience for people who make a difference. They are always bridging people—Sir Gus Nossal, magnificent scientist and brilliant communicator, Dr Jose Herrero, a medical doctor who ran the licensing department at Hoffman la Roche in Basel—a consummate businessman, scientist and wit, Dr John White, the American patent attorney who skilfully guides the Gene Shears intellectual property through the USA Patent office using his deep awareness of the molecular biology and of the legal and procedural requirements, Richard Pratt who is the closest Australian I can find to Josiah Wedgwood, with whom we began this reverie . . .

Ladies and gentlemen, I believe that our youngsters *are* awake to our nation's need. Lucy's choice confirms me in this. We must recognise the reality of the changed world and set our nation's policies to use best the skills, the intelligence, the creativity and the imagination which Australia will need to be the gold rush country of the 21st Century.

JOHN STOCKER FTS FRACP

Dr John Stocker was appointed Director, Research and Innovation, Pratt Industries in April 1995 on the completion of his five year term as Chief Executive of CSIRO Australia.

In 1970, Dr Stocker graduated top of his year in medicine at the University of Melbourne, and embarked on a career in Medical research. After his residency at the Royal Melbourne Hospital, he completed his Doctorate of Philosophy thesis at the Walter and Eliza Hall Institute of Medical Research in Melbourne under Sir Gustav Nossal.

From 1976 to 1978 Dr Stocker was a member of the Basel Institute for Immunology in Switzerland.

He joined the Swiss pharmaceutical company Hoffman-La Roche and Co. in its Basel headquarters in 1979. His first position in the company's Central Research Unit involved working on monoclonal antibodies and leading an international task force into the scientific and commercial opportunities offered by biotechnology-based vaccines.

In 1986, he was appointed the company's Director of Pharmaceutical Research and joined Hoffman-La Roche and Co's international Research Board.

Dr Stocker returned to Australia in 1987 to become the founding Managing Director of AMRAD Corporation Ltd, a company established to commercialise Australian biomedical discoveries.

He joined CSIRO in March 1990 as the first Chief Executive to be appointed from outside the Organisation.

Dr Stocker is a Director of Cambridge Antibody Technology Ltd, Circadian Technologies Ltd and Rothchild Bioscience Managers Ltd. He was a foundation member of the Prime Minister's Science Council, a member of the Australian Research Council and a member of the Australia China Council.

Dr Stocker is married and has two daughters. He plays tennis and has interests in viticulture and Australian native trees. The *Australian* newspaper named him 'Australian of the Year' in February 1992.